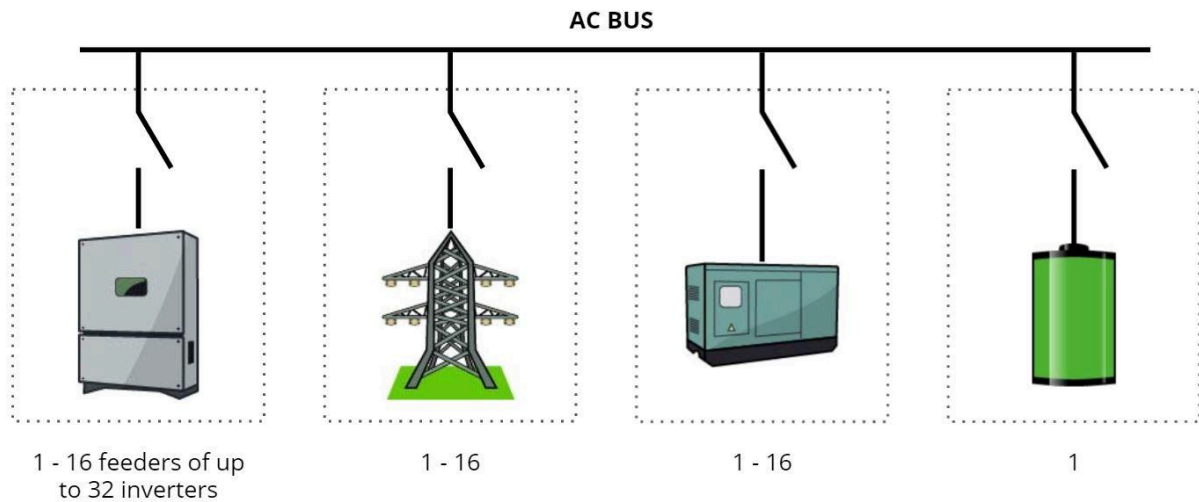


Microgrid / ESS

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1 Microgrid / ESS applications



1.1 Application description

ECpvX covers applications with any combination of 1-16 PV feeders, 1-16 grid connections, 1-16 gensets and 1 Battery Energy Storage System (BESS).

A PV feeder is defined as a point where solar power is fed into the AC system from a number of solar inverters. A grid connection is defined as a point where power can access the AC system from the utility

ECpvX controls the power and reactive power of both the PV plant and BESS via communication. Furthermore it offers Genset and Grid Management schemes for the starting/stopping of gensets and for the connection/disconnection of the grid. It can operate parallel to either gensets or grid or it can run purely on BESS and PV supply. In all operating modes it will prioritize PV power over BESS power.

In addition to controlling, the ECpvX also monitors a wide range of essential values that is visualised on its web server, ECweb

1.1.1 Grid mode

ECpvX controls the power output of the PV plant and the BESS and balances this towards the grid. By doing so, it can obtain:

- A fixed power and reactive power from the PV fed into the grid while having control of the power factor.
- Self consumption only covers internal load while making sure no power is fed to the grid. PV power is being prioritized over BESS power. Surplus of PV power can be used for charging the BESS before potential curtailment.
- The grid can be used for charging of the BESS.
- The BESS can be used as first priority backup in case the grid is failing before turning on gensets.

1.1.2 Genset mode

ECpvX controls the power output of the PV plant and the BESS safely with genset protection features:

- Ensuring minimum load on gensets. PV power is being prioritized over BESS power. Surplus of PV power can be used for charging the BESS before potential curtailment.
- Reverse power protection on the gensets.
- Spinning reserve of a certain percentage of the load (in combination with a synchronizing controller system).
- The gensets can be used for charging the BESS. If so, the BESS will run the genset at its most efficient operating point.
- The BESS can be used to keep up the loading on the genset in a low load scenario by charging the BESS.
- The BESS can be used as first priority backup in case the gensets are failing before connecting the grid.

1.1.3 Off Grid mode

ECpvX controls the power output of the PV plant and the BESS and solely supplies the load:

- PV power is being prioritized over BESS power. Surplus of PV power can be used for charging the BESS before potential curtailment.
- Grid can serve as a backup for the BESS.
- Gensets can serve as a backup for the BESS

All can be set up, adjusted and monitored through ECweb. The ECweb runs on PC's or mobile devices.

1.2 ECpvX type

As standard, the unit covers up to 16 PV feeders, 16 mains connections and 1 BESS in all variants and up to 16 gensets in all PV/Genset variants

All variants are capable of controlling power exported to the grid.

1.2.1 Variants

ECpvX Logger: Logging

ECpvX Solar: Only PV and BESS control and logging. Inverter power unlimited

ECpvX S: PV/Genset/grid and logging. PV Inverter and BESS power up to 100KW each

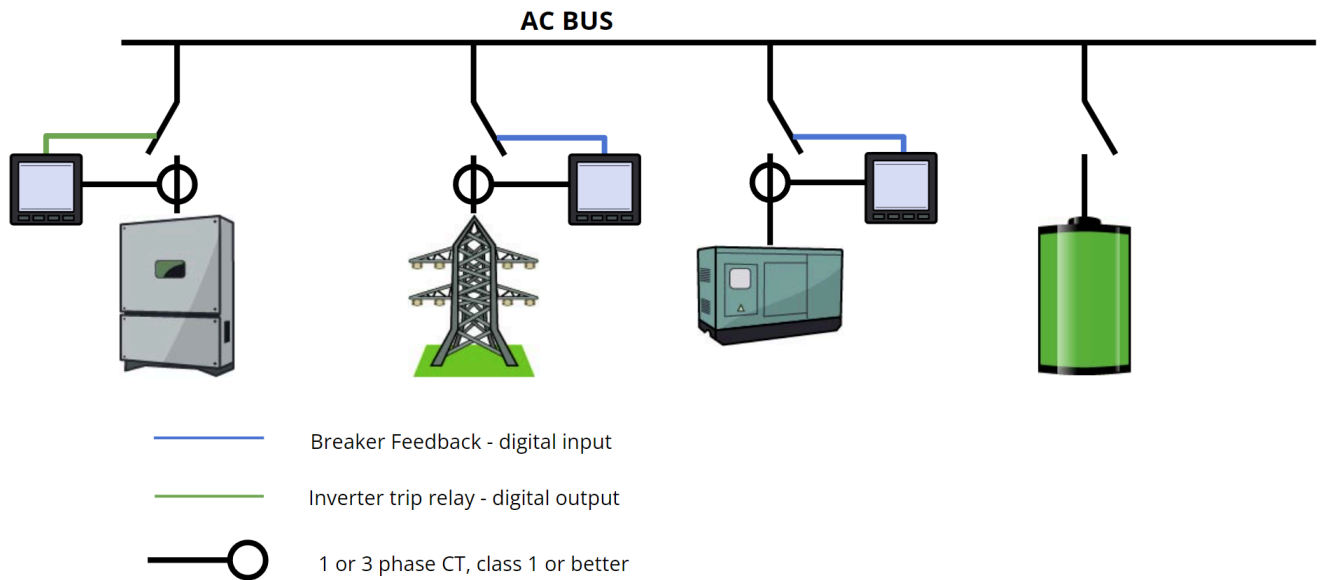
ECpvX M: PV/Genset/grid and logging. PV Inverter and BESS power up to 500KW each

ECpvX L: PV/Genset/grid and logging. PV Inverter and BESS power unlimited.

1.3 Features

- Off grid operation
- Genset reverse power protection
- Minimum load protection on gensets
- Fixed power and reactive control to grid
- Self consumption
- Grid feed in protection relay
- Stepless inverter power and reactive power control and monitoring via communication
- Universal interface to all inverter, power meters and generator controllers
- Consumption, production and PV performance monitoring and reporting
- Available as DIN rail mounted or as a ready to use solution

2 Power Measurements



ECpvX works on single or three phase AC systems.

At each connection of a power source, either a grid connection, a genset, a BESS or a string of inverters, a power measurement is required.

For the BESS it will come directly via the communication, whereas for the PV it can be read either from the inverters directly or from a power meter installed in front of the PV plant. Please note that the update speeds from the various inverters can vary highly.

Power measurements, when not measuring via inverters, is done through current transformers and the ECpvX will read the measurements via communication* from one of the supported genset controllers or power meters.

In case PV is backfeeding to utility, ECpvX can be set up to activate relay outputs on the PV power meter(s) installed. The relay(s) can be used to trip a breaker/contactor installed in front of the PV plant thereby disconnecting the PV plant.

In case PV is creating reverse power on the generators, ECpvX can be set up to activate relay outputs on the PV power meter(s) installed. The relay(s) can be used to trip a breaker/contactor installed in front of the PV plant thereby disconnecting the PV plant.

3 Communication

The ECpvX has in total 3 communication ports:

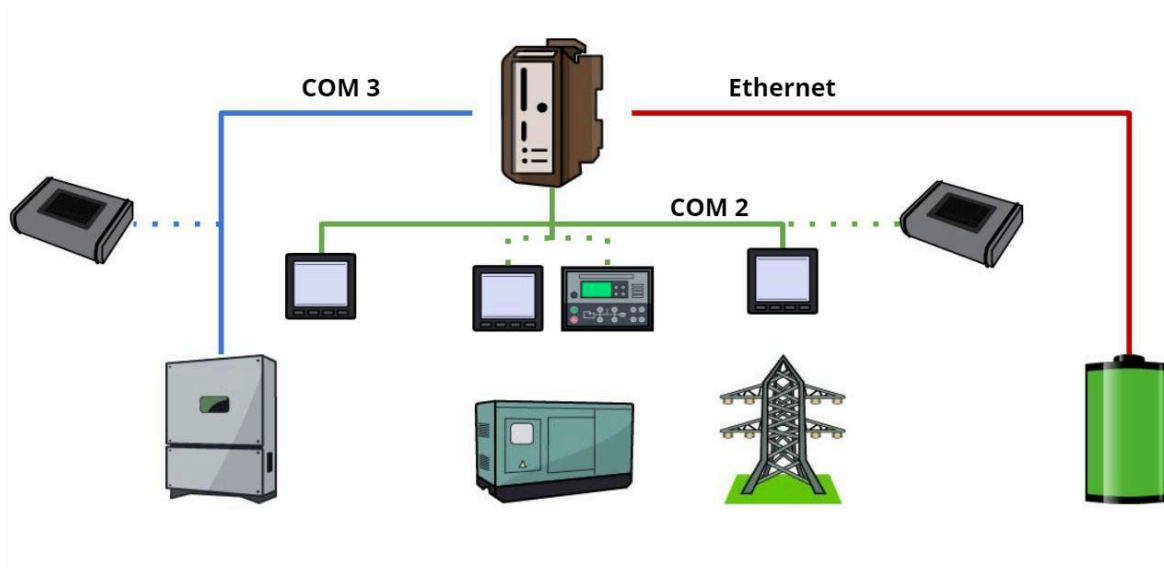
1. Ethernet: Modbus TCP
2. COM 2: RS-485
3. COM 3: RS-485

Using these ports a wide range of possible connections can be made to inverters, genset controllers, meters and sensors.

Even by controlling the inverters via Modbus TCP, you can have RS-485 meters for reading power and reactive power from other power sources.

As a general rule, meter/controller types on each power source/grid should be the same type. E.g. if using Pilot SPM-33 for the gensets, all gensets have to have this same type of meter.

3.1 RS-485



*for meter positioning and information, please refer to part 2 of this document.

COM 3 is the RS-485 which the PV inverters, BESS and sensors (can be on COM2 as well) are daisy chained on.

A total of:

- 32 PV inverters
- 1 BESS

32 modbus devices in total can be connected on the line without the use of modbus extenders.

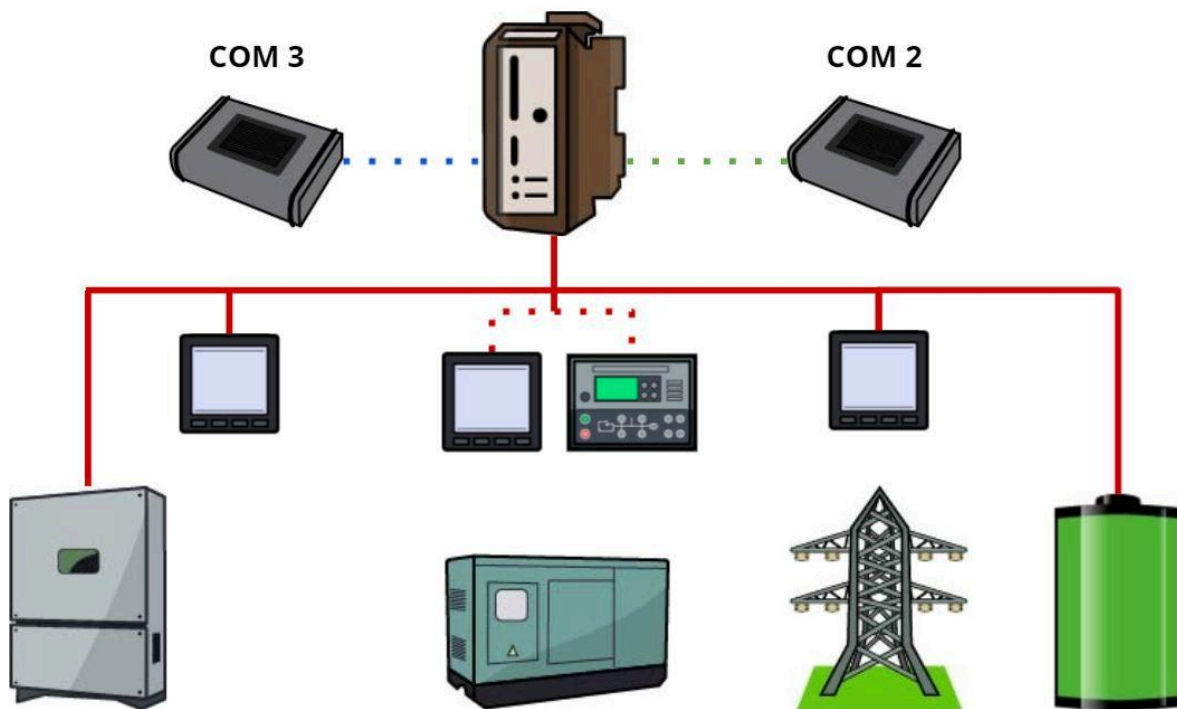
COM 2 is the RS-485 which meters or genset controllers are daisy chained on and optionally sensors.

A total of:

- 16 grid meters/controllers
- 16 PV feeders
- 16 genset controllers/meters

All supported devices can be found on www.encombi.com or in the ECpvX Data Sheet

3.2 Modbus TCP



*for meter positioning and information, please refer to part 2 of this document.

Ethernet can be used for connecting all devices in the application that communicates in Modbus TCP except from sensors - these are still to be connected on either COM2 or COM 3 port using RS-485.

Across the plant you can connect up to:

- 16 grid meters/controllers
- 16 PV feeders
- 16 genset controllers/meters
- 32 inverters
- 1 BESS

4 Interfaces

Below will follow a list of any devices the ECpvX can interface with. This list is being updated regularly.

4.1 PV inverters

Below listed inverters are all **SunSpec** based control and monitoring

Fronius, KACO, SMA (STP, SHP, CORE 1 and 2) , **Huawei** (Sun2000), **Delta** (RPIh7/10) and **Solvia, ABB** (Trio 50/60, PVS100/120, Uno), **REFUsoI** (8k to 100K)

Non SunSpec

Delta Solvia, **SolarEdge**, **Huawei** Smartlogger, SUN2000-8-28ktl, 33-42ktl, 50-75ktl, **ABB** Trio 8,5 - 27,6, **Sungrow** SG series and COM100E. **Schneider** Conext CL36 - CL125, **Growatt** & Growatt MAX, **Sofar Solar** 1-40 / 50-50, **KSTAR**, **Ginlong Solis**, **Polycab**, **Kehua** SPI-B, **GoodWe**, **AIWEI Solplanet**, **INVT**, INVT XG, **Chint** CPS 14-36kw & CPS SCA 18-36 kw, **WEG** 750SIW & WEG string inverters, **DEYE**, **SMA** Datamanager, **SOLAX**

4.2 Battery Energy Storage Systems

Megarevo Mega T series, **Sinexcel** PWS-2. PWS-1, PWG-2, **Sicon/Ecube** GRES & BRES, **Huawei** Luna2000, **ATESS** PCS, **Moura** BESS, **Sungrow** CP129 CP50-HV, **Cubenergy** PowerCombo, **NR** PCS-9765, **CERB** BESS, **AlphaESS** Storion, **Kehua** BCS Series

4.3 Battery Management Systems

Pylontech, **Green Tech** Caprack, **Kgooyer** BAMS, **Mica Power** MICS CBMS, **Pand Power** BMS PLD09

4.4 Genset Controllers

Cummins PC2.X, PC3.x, **Caterpillar** EMCP4, **DeepSea** GenComm, **DEIF** ML-2, CGC 400, **ComAp** IntelliSys, IntelliGen, IntelliCompact, AMF20, AMF25, IntelliLite9, **Woodward** EasyGen 2000, EasyGen 3000, LS-5, **Smartgen**: HGM400-series, HGM7X00, HGM9X00, **Lovato** RGK60, **Sices** GC310, GC350, GC500, MC100, **Kohler/SDMO** APM802

4.5 Power Meters

Pilot SPM 32, SPM 33, PMAC770, **Accuvim** L, EV300, **Schneider** EM64XX, PM1200, PM2XXX, PM5100, 5300, 5500, **Entes** EMP-07S. **Janitza** UMG96RM. **DEIF** MIC-2, **Phoenix** EEM-EM3XX, EMpro, **Eastron** SDM630, X96-series, **Klemsan** Ercas, Krea & Powys. **Socomec** Diris A40, **Chint** DTSU666, **ABB** M4M 20, M4M 30, **Secure Meters** 440, 300, **Algodue** UPM209, **Carlo Gavazzi** EM330, **DFUN** DFPM93, **Lettel** MCX-34V, **Acrel** ADL3000-E, **Selec** MFM384, **SMA** Datamanager, **Huawei** Smartlogger

4.6 Sensors

IMT Si-RS485TC-2T-MB, **MeteoControl** Si-RS485TC-2T-MB, **SevenSolar** (RS-485 based), **SevenSolar**, **Sungrow** PC-4, **Rainwise** PV-MET-100-2, **Soluzione Solar**

LiteMeter Pro, SunMeter Pro. Envmeteter Pro, SunMeter Pro Wind, Windmeter,
Hukseflux SR05, **Kipp Zonen** SMP-series, **BDsensor** DCL531, **SAH Electronics**
XY-MD02

If you do not find the interface you need for your project, please contact us at
support@encombi.com